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DIFFERENT WEED MANAGEMENT PRACTICES IN MACHINE TRANSPLANTED RICE (*Oryza sativa* L.)

R. B. NEGALUR[1] & A. S. HALEPYATI[2]

[1]Assistant Professor of Agronomy Krishi Vigyan Kendra, ARS, Campus Gangavati, UAS, Raichur, Karnataka, India

[2]Professor & Head, Division of Agronomy, University of Agricultural Sciences, Raichur, Karnataka, India

ABSTRACT

Field experiment on "effect of different weed management practices in machine transplanted rice (*Oryza sativa* L.)" was conducted at Agricultural Research Station, Gangavathi, University of Agricultural Sciences, Raichur, Karnataka during *kharif,* 2012 and 2013 under irrigated condition in clay soil. Pooled mean indicated that, among the different weed management practices, application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space recorded significantly lower grassy weed population and dry weight at 40, 60 DAT and at harvest (1.98, 2.47, 2.97/ 0.25 m^2 and 1.00, 1.20, 1.47 g /0.25 m^2, respectively), sedge weed population and dry weight (2.61, 3.21, 3.52 / 0.25 m^2 and 1.19, 1.48, 1.71 g /0.25 m^2, respectively) and broad leaved weed population and dry weight (1.68, 2.10, 2.52 / 0.25 m^2 and 0.91, 1.06, 1.28 g /0.25 m^2, respectively), leaf area index (4.09), DMP in leaves (14.04 g $plant^{-1}$), DMP in stem (29.03 g $plant^{-1}$), DMP in panicles (39.33 g $plant^{-1}$), filling percent (89.59), test weight (18.29 g), grain yield (5160 kg ha^{-1}), straw yield (6482 kg ha^{-1}), gross returns (` 92,212 ha^{-1}), net returns (`` 50,410 ha^{-1}) and B:C of 2.22 over unweeded check.

KEYWORDS: Conoweeder, Hand Weeding, Low Land Power Operated Paddy Weeder, Post Emergent, Pre-emergent

INTRODUCTION

Rice (*Oryza sativa* L.) is cultivated in command areas of Cauvery basin in South, Tungabhadra and Upper Krishna commands in North where manual transplanting is the major method of planting. In Northern Karnataka that too in Hyderabad - Karnataka region, major paddy area is concentrated in Koppal, Raichur, Yadgir and Bellary districts. The area under rice in Karnataka is 1.54 m ha with an annual production of 3.9 million tonnes and with a productivity of 2974 kg per ha (Anon., 2010).

Weeds grow faster and absorb the available nutrients earlier and faster resulting in deprivation of nutrients for the rice. Hence, weed management during the early period of rice is one of the most critical factor for successful production of rice. Present conventional method of manual weeding is effective method of weed control. But, it is not advantageous as it is costlier, time consuming. Manually it is difficult to differentiate and remove the grassy weeds particularly *Echinochloa colonum* and *Echinochloa crusgalli* due to phenotypical similarities between weeds and rice seedlings in early stages. In such a situation, the chemical weed control becomes an alternative method for weed control.

Chemical weeding preferably the application of pre-emergent herbicide is a vital tool for effective and cost efficient weed control in rice, which encounters weed competition from the day of germination. Adjusting the time of

application, reducing the dose of the herbicide or use of herbicides in sequence can improve selectivity and adequate weed control in transplanted rice.

Manually operated cono weeder at various Universities in India showed reduced drudgery due to less time taken (50-55 %) compared to hand weeding. The use of equipment also resulted in saving of cost of operation by 45 per cent. Farmers are of the opinion that cono weeder operation in standing position of operator allowed weeding without fatigue (Dixit and Khan, 2009).

MATERIALS AND METHODS

A field experiment was conducted at Agricultural Research Station, Gangavathi, University of Agricultural Sciences, Raichur, during *kharif*, 2012 and 2013. The experiment was laid in Randomized Block Design. The soil of the experimental site was medium deep black clay with soil reaction (8.2), electrical conductivity (2.1), available N (247.2 kg ha^{-1}), available P_2O_5 (50.2 kg ha^{-1}) and available K_2O (357.6 kg ha^{-1}) at surface 0-20 cm soil depth.

Agricultural Research Station, Gangavathi is situated in the Northen Dry Zone of Karnataka between 15^o 15' 40" North latitude and 76^o 31' 40" East longitude at an altitude of 419 m above mean sea level and represents irrigated transplanted rice belt of Tungabhadra command area. The experiment consisted twelve different weed management practices viz., pre- emergent application of butachlor 50 EC fb hand weeding at 30 DAT (T_1), Bensulfuron methyl 0.6% + Pretilachlor 6% fb hand weeding at 30 DAT (T_2), Butachlor 50 EC fb 2, 4-D Sodium salt 80 WP at 25 DAT (T_3), Butachlor 50 EC fb Bispyriback sodium 10 SC at 25 DAT (T_4), Bensulfuron methyl 0.6% + Pretilachlor 6% fb 2, 4 - D fb Sodium salt 80 WP at 25 DAT (T_5), Bensulfuron methyl 0.6% + Pretilachlor 6% fb Bispyriback sodium 10 SC 25 DAT (T_6), Butachlor 50 EC fb power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space (T_7), passing of power operated low land rice weeder at 20 and 30 DAT with hand weeding in intra row space (T_8), passing of Conoweeder twice at 10 and 20 DAT fb hand weeding at 30 DAT (T_9) and two hand weedings at 20 and 40 days after transplanting (T_{10}) were compared with unweeded control (T_{11}) and weed free check (T_{12}). The land was prepared using tractor drawn cultivator twice, followed by puddling twice with disc puddler and finally levelled using tractor drawn spike tooth harrow and kept ready for planting. Weed control treatments were imposed as per the combination of pre, post emergent herbicides and use of weeders, time and dosage of the chemicals. From the day of transplanting upto 10 days, a thin film of water was maintained and thereafter 5 cm standing water was maintained up to 10 days before harvesting. Water was drained during fertilizer application and spraying of weedicides and chemicals. Recommended dose of fertilizers (150:75:75 and 20 N: P_2O_5: K_2O and $ZnSO_4$ kg/ha) were applied as per the recommendation and time. Urea, Di-ammonium phosphate (DAP) and Muriate of potash (MOP) were used to supply N, P and K respectively. Before application, the land was drained and fertilizers were uniformly broadcasted over the field followed by letting in of water 24 hours after application. To control leaf folder and stem borer, Monocrotophos @ 1000 ml ha^{-1} was sprayed at 25 and 50 days after transplanting and one spray of Streptomycin sulphate @ 60 g ha^{-1} was taken up to control the bacterial leaf blight. Similarly to control brown plant hopper, one spray of Buprofezin and DDVP @ 625 ml and 625 g ha^{-1} was taken up during both the years of study. The crop was harvested at physiological maturity, threshed and cleaned manually in both the years. The weed count of different weeds from 0.25 squre meter area was recorded at 20 days interval and then the weeds after washing in water were sun dried and then oven dried at 65 ^oC and the dry weight of weeds were recorded and expressed in grams. Both grain and straw were sun dried for a week and dry weights were recorded. For computing the cost of cultivation, different variable cost of items was considered. The cost includes expenditure on seeds,

fertilizer, weedicides, irrigation, plant protection chemicals, hiring charges of transplanter, conoweeder, low land power operated paddy weeder, fuel cost and labour charges prevailed in market during 2012 and 2013.

RESULTS AND DISCUSSIONS

Weed Population and Dry Weight

Different weed control treatments had significant influence on weed population and weed dry weight at all the growth stages. Pooled mean revealed that, significantly lower weed population and dry weight at all the growth stages was recorded with weed free check. Among the different weed management practices, at 20 DAT, application of bensulfuron methyl 0.6% + pretilachlor 6% fb bispyriback sodium 10 SC at 20 DAT recorded significantly lower grassy weed population and dry weight (1.37/ 0.25 m^2 and 1.44 g /0.25 m^2, respectively), lower sedge weed population and dry weight (1.86 / 0.25 m^2 and 0.95 g /0.25 m^2, respectively) and broad leaved weed population and dry weight (1.44 / 0.25 m^2 and 0.84 g /0.25 m^2, respectively). Indicating the effectiveness of pre- emergent herbicides at early stage (Table 1, 2 and 3).

Whereas application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces recorded significantly lower grassy weeds population and dry weight at 40, 60 DAT and at harvest (1.98, 2.47, 2.97/ 0.25 m^2 and 1.00, 1.20 and 1.47 g /0.25 m^2 , respectively), sedge weeds population and dry weight (2.61, 3.21, 3.52/ 0.25 m^2 and 1.19, 1.48 and 1.71 g /0.25 m^2 , respectively) and broad leaved weeds population and dry weight (1.68, 2.10, 2.52/ 0.25 m^2 and 0.91, 1.06 and 1.28 g /0.25 m^2 , respectively) over unweeded control. Herbicide application in sequence was found to be better than single application of herbicides and in combination with weeders .These results are in conformity with findings of Srivastava *et al.* (2008), Bhanu Rekha *et al*. (2004), and Swapan Kumar Maity and Mukherjee (2009).

Growth and Yield Parameters

Different weed management practices noticed significant response by the rice crop. Pooled data of two years indicated that, all the growth and yield parameters were significantly higher with weed free check. Among the different weed management practices, application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces recorded significantly higher leaf area index (4.09), DMP in leaves (14.04 g $plant^{-1}$), DMP in stem (29.03 g $plant^{-1}$), DMP in panicles (39.33 g $plant^{-1}$), the yield parameters like filling percent (89.59) and test weight (18.29 g), grain yield (5160 kg ha^{-1}) and straw yield (6482 kg ha^{-1}) over unweeded control, but was found to be on par with application of bensulfuron methyl 0.6% + pretilachlor 6% fb bispyriback sodium 10 SC and bensulfuron methyl 0.6% + pretilachlor 6% fb 2, 4 - D sodium salt 80 WP (Table 4 and 5). This work is in conformity with the work of Bhat *et al*. (2008) and Sunil *et al.* (2010) who recorded such increased dry matter production in rice grown under wet land condition and attributed the differences due to better growth of plants on account of reduced weed competition at critical crop growth stages, resulting in increased availability of nutrients, space and light. Similar results were also reported by Sathyanarayana *et al*. (1997), Behera and Jena (1998) and Walia *et al*. (2008).

Economics

Weed free check recorded significantly higher gross returns (Rs. 95,105) when compared to rest of the treatments but was found to be on par with application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces (Rs. 92,212), bensulfuron methyl 0.6% + pretilachlor 6% fb bispyriback sodium 10 SC (Rs. 91,549) and bensulfuron methyl 0.6% + pretilachlor 6% fb 2, 4 - D sodium salt 80 WP (Rs.

88,229). Whereas net returns were higher with application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces (Rs. 50,410) compared to unweeded control (Rs. 19,376) and it was followed by weed free check (Rs. 49,801) (Table 5). Even though the gross returns were the highest with weed free check, the net returns were higher with application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space, which is because of higher cost of cultivation due to manual weeding when compared to cost incurred for herbicide and power weeder.

Application of butachlor 50 EC fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row spaces recorded higher B:C (2.22) as compared to weed free check. However, in weed free check, the B:C (2.12) was lesser even though the grain yield and gross returns were higher and was due to higher cost of cultivation as a result of high cost incurred towards labour for weeding (Table 5). Due to the severe crop weed competition throughout the crop growth period resulting in decreased growth and yield contributing parameters, the unweeded control recorded significantly the lowest B:C (1.53). These results are in conformity with the findings of Sunil *et al.* (2010) and Pasha *et al.* (2012).

CONCLUSIONS

The study thus indicated that, application of pre emergent herbicide butachlor 50 EC @ 2.5 lit ha^{-1} fb passing of power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space was found to be most effective and economical. The next best treatments were sequential application of bensulfuron methyl 0.6% + pretilachlor 6% fb bispyribac sodium 10 SC and bensulfuron methyl 0.6% + pretilachlor 6% fb 2, 4-D sodium 80 WP.

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APPENDICES

Table 1: Grassy and Sedge Weed Population as Influenced by weed Control Treatments in Machine Transplanted Rice at Different Growth Stages (Pooled Data of 2012 and 2013)

Treatment	Grassy Weed Population (No. /0.25 m²)				Sedge Weed Population (No. /0.25 m²)			
	20 DAT	40 DAT	60 DAT	At harvest	20 DAT	40 DAT	60 DAT	At harvest
T_1: Butachlor 50 EC fb H W at 30 DAT	1.73 (2.50)	3.77 (13.74)	4.19 (17.02)	4.47 (19.52)	2.17 (4.22)	4.10 (16.32)	4.50 (19.79)	4.71 (21.72)
T_2: Bensulfuron methyl 0.6% + Pretilachlor 6% fb hand weeding at 30 DAT	1.42 (1.53)	3.46 (11.49)	3.86 (14.43)	4.40 (18.88)	2.07 (3.78)	3.99 (15.40)	4.30 (18.02)	4.52 (19.92)
T_3: Butachlor 50 EC fb 2, 4-D Sodium salt 80 WP	1.75 (2.56)	3.43 (11.24)	3.85 (14.33)	4.35 (18.38)	2.18 (4.25)	3.91 (14.82)	4.29 (17.91)	4.51 (19.81)
T_4: Butachlor 50 EC fb Bispyriback sodium 10 SC	1.80 (2.74)	3.28 (10.24)	3.79 (13.89)	4.28 (17.81)	2.24 (4.51)	3.83 (14.18)	4.21 (17.23)	4.47 (19.51)
T_5: Bensulfuron methyl 0.6% + Pretilachlor 6% fb2, 4, D fb Sodium salt 80 WP	1.42 (1.51)	2.55 (5.99)	3.37 (10.84)	3.72 (13.33)	1.92 (3.21)	3.36 (10.78)	3.73 (13.43)	4.04 (15.80)
T_6: Bensulfuron methyl 0.6% + Pretilachlor 6% fb Bispyriback sodium 10 SC	1.37 (1.37)	2.33 (4.92)	2.86 (7.67)	3.45 (11.41)	1.86 (2.95)	2.98 (8.38)	3.47 (11.53)	3.76 (13.64)
T_7: Butachlor 50 EC fb power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space	1.81 (2.77)	1.98 (3.44)	2.47 (5.62)	2.97 (8.31)	2.28 (4.69)	2.61 (6.32)	3.21 (9.82)	3.52 (11.89)
T_8: Power operated low land rice weeder (20 and 30 DAT) with hand weeding in intra row space	2.10 (3.90)	2.76 (7.10)	3.67 (13.01)	3.89 (14.64)	2.59 (6.22)	3.68 (13.04)	4.04 (15.84)	4.28 (17.78)
T_9: Conoweeder (Twice at 10 and 20 DAT) fb handweeding at 30 DAT	1.82 (2.81)	2.74 (7.02)	3.51 (11.84)	3.88 (14.55)	2.38 (5.18)	3.43 (11.29)	3.90 (14.72)	4.17 (16.90)
T_{10}: Two hand weedings at 20 and 40 days after transplanting	2.09 (3.85)	2.95 (8.19)	3.70 (13.18)	4.13 (16.56)	2.42 (5.34)	3.71 (13.29)	4.03 (15.78)	4.31 (18.08)
T_{11}: Unweeded control	3.84 (14.25)	5.13 (25.78)	6.03 (35.88)	6.29 (39.07)	4.55 (20.22)	6.88 (46.80)	6.62 (44.35)	6.97 (48.04)
T_{12}: Weed free check	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
S.Em±	0.11	0.13	0.15	0.17	0.09	0.13	0.16	0.17
C.D. (P=0.05)	0.33	0.38	0.44	0.50	0.27	0.40	0.48	0.51

* Figures in parentheses indicate original values DAT –Days after transplanting

Table 2: Broad Leaved Weed Population and Dry Weight of Grassy Weeds as Influenced by Weed Control Treatments in Machine Transplanted Rice at Different Growth Stages (POOLED Data of 2012 and 2013)

Treatment	Broad Leaved Weed Population (No. /0.25 m²)				Dry Weight of Grassy Weeds (g /0.25 m²)			
	20 DAT	40 DAT	60 DAT	At harvest	20 DAT	40 DAT	60 DAT	At harvest
T_1: Butachlor 50 EC fb H W at 30 DAT	1.72 (2.46)	3.32 (10.52)	3.73 (13.4)	4.28 (17.85)	0.90 (0.31)	1.59 (2.02)	1.83 (2.84)	2.10 (3.90)
T_2: Bensulfuron methyl 0.6% + Pretilachlor 6% fb hand weeding at 30 DAT	1.64 (2.2)	3.29 (10.30)	3.79 (13.9)	4.16 (16.85)	0.85 (0.22)	1.48 (1.69)	1.70 (2.41)	2.07 (3.78)
T_3: Butachlor 50 EC fb 2, 4-D Sodium salt 80 WP	1.75 (2.58)	3.15 (9.42)	3.59 (12.4)	4.05 (15.88)	0.91 (0.32)	1.46 (1.65)	1.70 (2.39)	2.04 (3.68)
T_4: Butachlor 50 EC fb Bispyriback sodium 10 SC	1.80 (2.73)	3.05 (8.80)	3.49 (11.68)	3.97 (15.30)	0.93 (0.36)	1.42 (1.51)	1.68 (2.32)	2.01 (3.56)
T_5: Bensulfuron methyl 0.6% + Pretilachlor 6% fb2, 4, D fb Sodium salt 80 WP	1.54 (1.88)	2.20 (4.34)	2.72 (6.88)	3.14 (9.38)	0.83 (0.20)	1.17 (0.87)	1.52 (1.81)	1.78 (2.67)
T_6: Bensulfuron methyl 0.6% + Pretilachlor 6% fb Bispyriback sodium 10 SC	1.44 (1.57)	2.14 (4.08)	2.43 (5.41)	2.88 (7.80)	0.82 (0.18)	1.10 (0.72)	1.33 (1.28)	1.67 (2.28)
T_7: Butachlor 50 EC fb power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space	1.86 (2.96)	1.68 (2.32)	2.10 (3.93)	2.52 (5.85)	0.94 (0.39)	1.00 (0.51)	1.20 (0.94)	1.47 (1.66)
T_8: Power operated low land rice weeder (20 and 30 DAT) with hand weeding in intra row space	2.06 (3.73)	2.61 (6.30)	3.15 (9.41)	3.63 (12.65)	1.01 (0.53)	1.24 (1.05)	1.63 (2.17)	1.85 (2.93)
T_9: Conoweeder (Twice at 10 and 20 DAT) fb handweeding at 30 DAT	1.92 (3.2)	2.51 (5.81)	2.98 (8.38)	3.41 (11.10)	0.96 (0.42)	1.24 (1.04)	1.57 (1.98)	1.84 (2.88)
T_{10}: Two hand weedings at 20 and 40 days after transplanting	1.97 (3.37)	2.80 (7.35)	3.29 (10.33)	3.85 (14.29)	1.00 (0.51)	1.31 (1.21)	1.64 (2.20)	1.95 (3.31)
T_{11}: Unweeded control	3.19 (9.68)	4.96 (24.10)	5.37 (28.38)	5.68 (31.81)	1.55 (1.91)	2.16 (4.18)	2.40 (5.23)	3.01 (8.59)
T_{12}: Weed free check	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
S.Em±	0.07	0.14	0.16	0.18	0.02	0.04	0.06	0.07
C.D. (P=0.05)	0.20	0.41	0.47	0.53	0.06	0.12	0.018	0..21

* Figures in parentheses indicate original values DAT –Days after transplanting

Table 3: Dry Weight of Sedge and Broad Leaved Weeds as Influenced by Weed Control Treatments in Machine Transplanted Rice at Different Growth Stages (Pooled data of 2012 and 2013)

Treatment		Dry Weight of Sedge weeds (No. /0.25 m²)				Dry Weight of Broad Leaved Weeds (g /0.25 m²)			
		20 DAT	40 DAT	60 DAT	At harvest	20 DAT	40 DAT	60 DAT	At harvest
T_1:	Butachlor 50 EC fb H W at 30 DAT	1.04 (0.57)	1.70 (2.40)	1.98 (3.41)	2.24 (4.53)	0.90 (0.29)	1.41 (1.49)	1.63 (2.16)	1.90 (3.11)
T_2:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb hand weeding at 30 DAT	1.00 (0.51)	1.66 (2.26)	1.91 (3.14)	2.16 (4.16)	0.89 (2.24)	1.40 (1.46)	1.66 (2.24)	2.00 (3.50)
T_3:	Butachlor 50 EC fb 2, 4-D Sodium salt 80 WP	1.05 (0.60)	1.64 (2.19)	1.89 (3.09)	2.14 (4.09)	0.91 (0.20)	1.35 (1.33)	1.58 (2.00)	1.95 (3.31)
T_4:	Butachlor 50 EC fb Bispyriback sodium 10 SC	1.07 (0.64)	1.61 (2.11)	1.86 (2.97)	2.12 (3.98)	0.92 (0.34)	1.32 (1.24)	1.54 (1.88)	1.87 (3.00)
T_5:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb2, 4, D fb Sodium salt 80 WP	0.97 (0.44)	1.45 (1.59)	1.68 (2.32)	1.93 (3.23)	0.86 (1.24)	1.06 (0.62)	1.27 (1.11)	1.53 (1.84)
T_6:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb Bispyriback sodium 10 SC	0.95 (0.40)	1.32 (1.23)	1.58 (1.99)	1.81 (2.78)	0.84 (0.32)	1.04 (0.58)	1.17 (0.87)	1.42 (1.53)
T_7:	Butachlor 50 EC fb power operated low land rice weeder twice at 20 and 30 DAT with hand weeding in intra row space	1.08 (0.66)	1.19 (0.93)	1.48 (1.69)	1.71 (2.43)	0.94 (0.35)	0.91 (0.33)	1.06 (0.63)	1.28 (1.15)
T_8:	Power operated low land rice weeder (20 and 30 DAT) with hand weeding in intra row space	1.16 (0.84)	1.55 (1.90)	1.79 (2.7)	2.03 (3.64)	0.99 (0.48)	1.18 (0.89)	1.42 (1.52)	1.73 (2.48)
T_9:	Conoweeder (Twice at 10 and 20 DAT) fb handweeding at 30 DAT	1.10 (0.70)	1.47 (1.66)	1.74 (2.54)	1.99 (3.45)	0.95 (0.38)	1.15 (0.82)	1.36 (1.35)	1.64 (2.18)
T_{10}:	Two hand weedings at 20 and 40 days after transplanting	1.10 (0.72)	1.56 (1.94)	1.80 (2.75)	2.04 (3.68)	0.97 (0.44)	1.24 (1.04)	1.47 (1.67)	1.82 (2.80)
T_{11}:	Unweeded control	1.80 (2.73)	2.2.53 (5.91)	2.78 (7.22)	3.02 (8.61)	1.33 (1.24)	2.13 (4.03)	2.33 (4.95)	2.40 (5.25)
T_{12}:	Weed free check	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
	S.Em±	0.03	0.09	0.10	0.10	0.02	0.07	0.08	0.10
	C.D. (P=0.05)	0.08	0.27	0.28	0.30	0.06	0.21	0.23	0.30

* Figures in parentheses indicate original values DAT –Days after transplanting

Table 4: Leaf Area, Dry Matter Production in Leaves, Stem, Panicle and Test Weight of Rice as Influenced by Weed Control Treatments in Machine Transplanted Rice (Pooled data of 2012 and 2013)

Treatment		Leaf Area Index	DMP in Leaves (g plant^{-1})	DMP in Stem (g plant^{-1})	DMP in Panicle (g plant^{-1})	Filling Per Cent	Test Weight (g)
T_1:	Butachlor 50 EC fb H W at 30 DAT	2.95	11.87	20.43	30.33	83.44	17.24
T_2:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb hand weeding at 30 DAT	3.29	12.05	21.73	32.38	84.71	17.57
T_3:	Butachlor 50 EC fb 2, 4-D Sodium salt 80 WP	3.30	12.25	22.53	33.06	83.42	17.63
T_4:	Butachlor 50 EC fb Bispyriback sodium 10 SC	3.44	12.52	23.73	34.43	84.01	17.75
T_5:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb2, 4, D fb Sodium salt 80 WP	3.83	13.60	27.73	37.98	88.28	18.24
T_6:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb Bispyriback sodium 10 SC	3.91	13.67	28.63	38.83	88.89	18.26
T_7:	Butachlor 50 EC fb power operated low land rice weeder (twice at 20 and 30 DAT) with hand weeding in intra row space	4.09	14.04	29.03	39.33	89.59	18.29
T_8:	Power operated low land rice weeder (20 and 30 DAT) with hand weeding in intra row space	3.70	13.05	25.63	35.83	86.79	17.98
T_9:	Conoweeder (Twice at 10 and 20 DAT) fb handweeding at 30 DAT	3.77	13.35	26.43	36.83	87.38	18.16
T_{10}:	Two hand weedings at 20 and 40 days after transplanting	3.56	13.02	24.53	34.93	86.04	17.91
T_{11}:	Unweeded control	2.26	8.64	18.86	28.09	81.18	17.11
T_{12}:	Weed free check	4.20	14.00	29.69	41.05	91.15	18.38
	S.Em±	0.24	0.56	1.06	2.16	1.67	0.41
	C.D. (P=0.05)	0.72	1.64	3.14	6.37	4.86	1.22

Table 5: Grain Yield, Straw Yield, Cost of Cultivation, Gross Returns, Net Returns and B:C of Rice as Influenced by Weed Control Treatments in Machine Transplanted Rice (Pooled data of 2012 and 2013)

Treatment		Grain Yield (kg ha^{-1})	Straw Yield (kg ha^{-1})	Cost of cultivation (` ha^{-1})	Gross Returns (` ha^{-1})	Net Returns (` ha^{-1})	B:C
T_1:	Butachlor 50 EC fb H W at 30 DAT	4421	5561	41450	79013	37564	1.92
T_2:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb hand weeding at 30 DAT	4531	5682	42618	80955	38337	1.92
T_3:	Butachlor 50 EC fb 2, 4-D Sodium salt 80 WP	4581	5721	40189	81841	41652	2.05
T_4:	Butachlor 50 EC fb Bispyriback sodium 10 SC	4651	5887	41181	83147	41966	2.04
T_5:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb 2, 4, D fb Sodium salt 80 WP	4934	6271	43125	88229	45105	2.06
T_6:	Bensulfuron methyl 0.6% + Pretilachlor 6% fb Bispyriback sodium 10 SC	5125	6376	45297	91549	46253	2.05
T_7:	Butachlor 50 EC fb power operated low land rice weeder (twice at 20 and 30 DAT) with hand weeding in intra row space	5160	6482	41802	92212	50410	2.22
T_8:	Power operated low land rice weeder (20 and 30 DAT) with hand weeding in intra row space	4778	6043	42234	85410	43176	2.04
T_9:	Conoweeder (Twice at 10 and 20 DAT) fb handweeding at 30 DAT	4844	6147	40873	86613	45741	2.14
T_{10}:	Two hand weedings at 20 and 40 days after transplanting	4723	6009	41266	84448	43183	2.07
T_{11}:	Unweeded control	3185	3866	37438	56814	19376	1.53
T_{12}:	Weed free check	5325	6598	45305	95105	49801	2.12
	S.Em±	135	189	-	2558	1536	0.02
	C.D. (P=0.05)	396	557	-	7524	4518	0.07